Notice of Allowability	Application No.	Applicant(s)	
	10/766,485	LEE, JONG-WON	
	Examiner	Art Unit	
	George Nguyen	3723	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to *Applicant's amendment filed on March 17, 2005*.

2. ☒ The allowed claim(s) is/are *1-4,6-10 and 12-16*.

3. ☒ The drawings filed on *29 January 2004* are accepted by the Examiner.

4. ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
   a) ☒ All b) ☐ Some* c) ☐ None of the:
      1. ☒ Certified copies of the priority documents have been received.
      2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
      3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.

6. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
   (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
      1) ☐ hereto or 2) ☐ to Paper No./Mail Date _____.
   (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.

   Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).

7. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☒ Notice of References Cited (PTO-892)
2. ☐ Notice of Draftperson's Patent Drawing Review (PTO-948)
3. ☐ Information Disclosure Statements (PTO-1449 or PTO/SB/08), Paper No./Mail Date _____
4. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
5. ☐ Notice of Informal Patent Application (PTO-152)
6. ☐ Interview Summary (PTO-413), Paper No./Mail Date _____ .
7. ☐ Examiner's Amendment/Comment
8. ☒ Examiner's Statement of Reasons for Allowance
9. ☐ Other _____.

George Nguyen
Primary Examiner
Art Unit: 3723

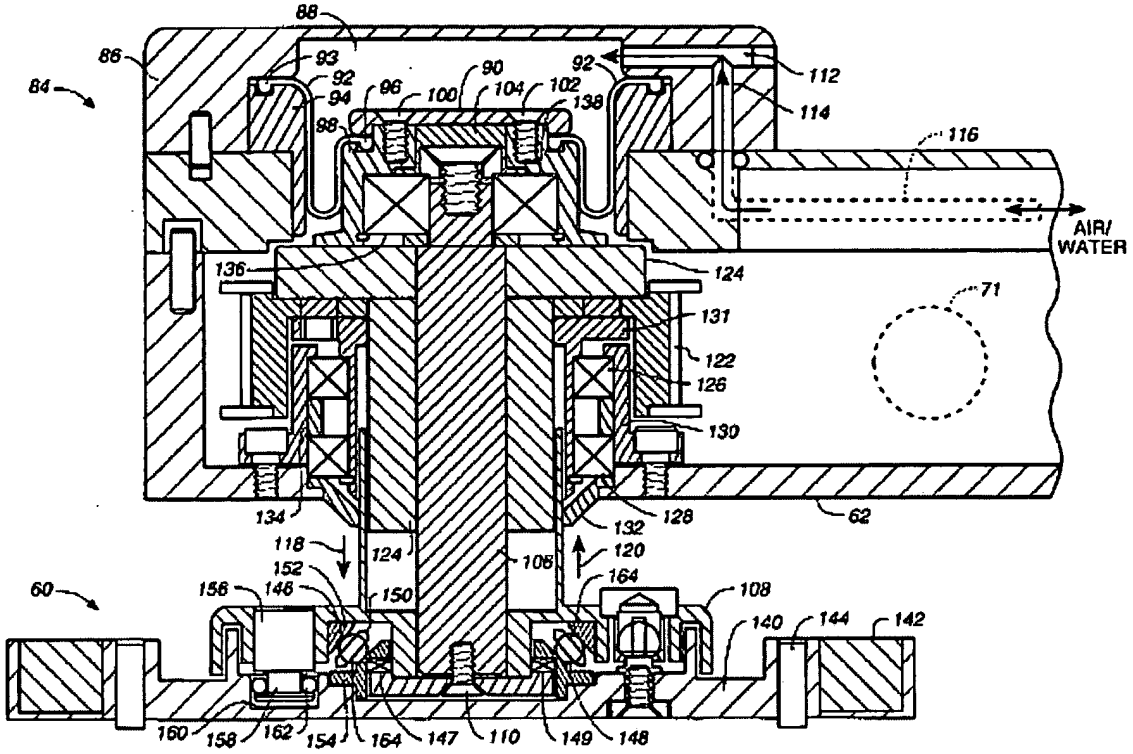
REASONS FOR ALLOWANCE

The following is an examiner's statement of reasons for allowance: the specific limitations of "said linear driving device ... between the first and second magnets" in the combination as claimed in claim 1, "said linear driving device ... by magnetic force between the first and second magnets" in the combination as claimed in claim 7, and "said linear driving device ... between the first and second magnets" in the combination as claimed in claim 12 are not anticipated nor made obvious by the prior art of record in the examiner's opinion. For example, with reference to Figure 4C, col. 3-4, Perlov discloses the claimed invention including the following:

(1) a disk holder (140) supporting a polishing disk.

(2) a conditioner head (60) having a rotary drive (122/124).

(3) a linear driving device (84) coupled conditioner head (60) to arm (62) to drive conditioner head (60) between an extended position and a retracted position.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38 for moving cassettes 28 from a holding station 39 into tub 24 and a substrate blade 40 for transferring substrates from tub 24 to transfer station 16.

Carousel 18 has a support plate 42 with slots 44 through which shafts 46 of carrier heads 20 extend. Carrier heads 20 can independently rotate and oscillate back-and-forth in slots 44 to achieve a uniformly polished substrate surface. Carrier heads 20 are rotated by respective motors 48, which are normally hidden behind removable sidewalls 50 of carousel 18. In operation, a substrate is loaded from tub 24 to transfer station 16, from which the substrate is transferred to a carrier head 20; carousel 18 then transfers the substrate through a series of one or more polishing stations 14 and finally returns the polished substrate to transfer station 16.

Each polishing station 14 includes a rotatable platen 52, which supports a polishing pad 54, and a pad conditioner 56; platen 52 and conditioner 56 are both mounted to a tabletop 57 inside polishing apparatus 10. Each pad conditioner 56 includes a conditioner head 60, an arm 62, and a base 64 for positioning conditioner head 60 over the surface of a polishing pad 54 to be conditioned. Each polishing station 14 also includes a cup 66, which contains a fluid for rinsing conditioner head 60.

Referring to FIGS. 2A and 2B, in one mode of operation, polishing pad 54 is conditioned by pad conditioner 56 while polishing pad 54 polishes a substrate which is mounted on carrier head 20. Conditioner head 60 sweeps across polishing pad 54 with a motion that is synchronized with the motion of carrier head 20 across polishing pad 54. For example, a carrier head 20 with a substrate to be polished may be positioned in the center of polishing pad 54 and conditioner head 60 may be immersed in a rinsing fluid contained within cup 66. During polishing, cup 66 may pivot out of the way as shown by arrow 69, and conditioner head 60 carrying a substrate may be swept back-and-forth across polishing pad 54 as shown by arrows 70 and 72, respectively. Three water jets 71, 73, and 75 may direct streams of water toward polishing pad 54 to rinse slurry from the pad surface.

For further details regarding the general features and operation of polishing apparatus 10, please refer to co-pending application Ser. No. 08/549,336, filed, Oct. 27, 1995, by Perlov et al., entitled "Continuous Processing System for Chemical Mechanical Polishing," and assigned to the assignee of the present invention, which is herein incorporated by reference.

Referring to FIG. 3A, it has been realized that when a driving force (F_{driver}) is applied to a conditioner head 75 from a position that does not lie along a line that is normal to a polishing pad surface 76, the driving force and the responsive normal force (F_{normal}) result in a counterclockwise torque (T) that tends to raise conditioner head 75 off polishing pad surface 76. Such torque generation may lead to instability and thereby reduce the ability to controllably apply force against polishing pad surface 76. As shown in FIG. 3B, when, in accordance with one aspect of the invention, actuating force is applied to conditioner head 60 from a position that lies along a line 82 which is substantially normal to polishing pad surface 76, the normal force and the driving force both lie along the same line 82 and little or no torque is generated. The invention therefore allows force to be controllably and stably applied against polishing pad surface 76, improving the uniformity with which a polishing pad surface can be conditioned and thereby improving the overall polishing process.

Referring to FIGS. 4A and 4B, support arm 62 of pad conditioner 56 has one end coupled to conditioner head 60 and another end coupled to base 64, which sweeps conditioner head 60 across a polishing pad surface. A driver 84 couples conditioner head 60 to arm 62 and drives conditioner head 60 between an extended position (FIG. 4A) and a retracted position (FIG. 4B). As explained above, driver 84 applies an actuating force to conditioner head 60 from a position that lies along a line that is substantially normal to the polishing pad surface to be conditioned, so as to significantly reduce the amount of torque generated in polishing pad conditioner 56.

Referring to FIG. 4C, driver 84 includes a housing 86 that defines an interior portion of a fluid cavity 88. Fluid cavity 88 is further defined by a face plate 90 and a fluid membrane 92, which is made of neoprene rubber with, for example, a hardness of about 40 durometer and a thickness of about 0.03 inch. Fluid membrane 92 has one end 93 that is attached to housing 86 by an annular clamp 94 and another end 96 that is attached to face plate 90 by an annular clamp 98 which is coupled to face plate 90 by bolts 100, 102. A flange 104 couples face plate 90 to a spline shaft 106 which is, in turn, coupled to a flange 108 of conditioner head 60 by a bolt 110. In operation, fluid cavity 88 receives pressurized air through fluid channels 112 and 114 defined in driver housing 86 and through a fluid channel 116 which extends through arm 62 and through base 64 to an inlet port 117 (FIG. 4A). The build-up of air pressure inside fluid cavity 88 drives face plate 90, spline shaft 106, and conditioner head 60 in the direction indicated by arrow 118. As air is evacuated from fluid cavity 88, the reduction in air pressure in fluid cavity 88 causes face plate 90, spline shaft 106, and conditioner head 60 to retract in the direction indicated by arrow 120.

Fluid channel 116 includes separate tubes for respectively receiving air and a rinsing solution, such as water. The rinsing solution tube is coupled to water jets 71, 73, and 75 located along arm 62 (see FIGS. 2A, 2B, and 4A). The rinsing solution may be used to rinse a polishing pad surface before, during, or after polishing to prevent the build-up of slurry deposits.

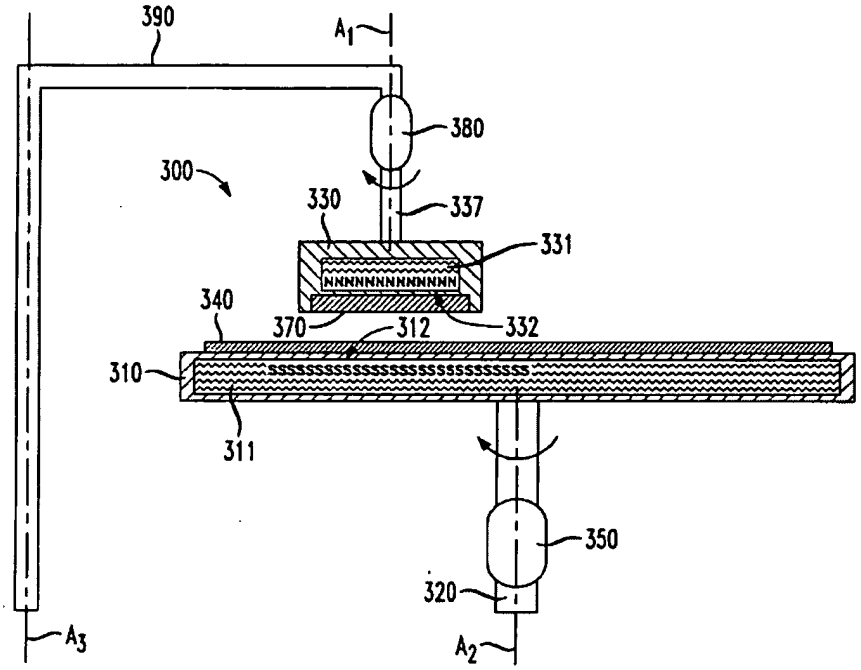
Driver 84 also includes a toothed sheave 122 which is coupled to a spline nut 124. Toothed sheave 122 and spline nut 124 are rotated by a toothed drive belt (not shown) which is driven by a motor in base 64 (discussed in detail below). Spline nut 124 engages spline shaft 106 and thereby causes spline shaft 106 and conditioner head 60 to rotate when driven by the drive belt. A pair of annular bearings 126, 128 are held in place between arm 62 and spline nut 124 by an upper collars 130, 131 and a lower collar 132; annular bearings 126, 128 are spaced apart by an annular spacer 134. Annular bearings 126, 128 allow spline nut 124 to rotate freely with respect to arm 62. A pair of bearings 136, 138 allow spline nut 124 and spline shaft 106 to rotate freely with respect to face plate 90.

Conditioner head 60 includes a face plate 140 which has an annular magnet 142 for holding in place an end effector (not shown) which is used to condition a surface of a polishing pad; pins 144 are used to engage and thereby transfer torque to an end effector held to face plate 140. Face plate 140 and flange 108 are coupled together by a gimbal mechanism which includes a plurality of ball bearings 146, 148 seated within holes in an annular cage 150 and positioned between an upper annular race 152 and a lower annular race 154. Ball bearings 146, 148 and springs 147, 149 allow face plate 140 to nutate with respect to spline shaft 106. The degree of nutation is limited by three torque transfer pins 156 which are mounted to flange 108 (only one torque transfer pin is shown in FIG. 4B). Torque transfer pins 156 have protrusions 158 which extend into recesses

With reference to Figure 4, col. 5, lines 15-35, Easter et al.'6,234,868 discloses a magnetic force control comprising a set of oppositely polarized magnetic regions 311 (lying directly below the polishing platen 310) and 331 (lying directly above conditioning head 330). By controlling the degree of attraction between the magnetic regions, the force exerted on conditioning head 330 can be effectively controlled, and the consistency of the conditioning process can be improved.

> The force control mechanism can also comprise a set of oppositely polarized magnetic regions. FIG. **4** shows such a conditioning device **300** according to a second embodiment of the present invention. The device **300** has similar components to the device **200** shown in FIG. **2**, and like reference numerals denote like elements. The device **300** comprises first **331** and second **311** magnetic regions defining a force control mechanism. A portion **332** of the first magnetic region **331** which lies directly above a conditioning head **330** is of a specific polarity (e.g. north), and a portion **312** of the second magnetic region **311** which lies directly below a polishing pad **340** is of a specific polarity which is opposite to that of the first portion (e.g. south). The opposing polarity portions **332, 312** cause the conditioning head **330** and the polishing platen **310** to be attracted to one another. A current source (not shown) varies the current through magnetic regions **331,311** in order to control the degree of attraction. By controlling the degree of attraction between the magnetic regions, the force exerted on conditioning head **330** can be effectively controlled, and the consistency of the conditioning process can be improved.

FIG. 4



However, the prior art of record fails to provide or suggest the specific limitations of "said linear driving device ... between the first and second magnets" in the combination as claimed in claim 1, "said linear driving device ... by magnetic force between the first and second magnets" in the combination as claimed in claim 7, and "said linear driving device ... between the first and second magnets" in the combination as claimed in claim 12 are not anticipated nor made obvious by the prior art of record in the examiner's opinion.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Any inquiry concerning this communication or earlier communications from the examiner should be directed to George Nguyen whose telephone number is 571-272-4491. The examiner can normally be reached on Monday-Friday/630AM-300PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Joseph Hail can be reached on 571-272-4485. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

GEORGE NGUYEN
PRIMARY EXAMINER

George Nguyen
Primary Examiner
Art Unit 3723

GN – April 25, 2005